

CONTENTS

SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2002

PREFACE	ix
EXECUTIVE SUMMARY	xiii
CHAPTER 1: CONTROLLED SUBSTANCES AND OTHER SOURCE GASES	
<i>Lead Authors: S.A. Montzka and P.J. Fraser</i>	
Scientific Summary	1.1
1.1 Introduction	1.5
1.2 Halogenated Ozone-Depleting Gases in the Atmosphere	1.5
1.3 Halocarbon Sources Estimated from Industrial Production	1.19
1.4 Halocarbon Lifetimes, Ozone Depletion Potentials, and Global Warming Potentials	1.21
1.5 Methyl Bromide and Methyl Chloride	1.36
1.6 Atmospheric Halocarbon Observations Compared with Expectations	1.44
1.7 Other Trace Gases	1.51
1.8 Halogenated Source Gases in the Future	1.61
References	1.71
CHAPTER 2: VERY SHORT-LIVED HALOGEN AND SULFUR SUBSTANCES	
<i>Lead Authors: M.K.W. Ko and G. Poulet</i>	
Scientific Summary	2.1
2.1 Introduction	2.5
2.2 Dynamical and Chemical Characteristics of the Upper Troposphere (UT) and the Tropical Tropopause Layer (TTL)	2.7
2.3 Atmospheric Chemistry of Halogenated Very Short-Lived (VSL) Substances	2.15
2.4 Contribution of Halogenated VSL Substances to the Stratospheric Inorganic Halogen Budget	2.25
2.5 Estimates for the Potential Impact of Halogenated VSL Substances on Column Ozone	2.34
2.6 VSL Sulfur Species and Stratospheric Aerosols	2.39
References	2.44
CHAPTER 3: POLAR STRATOSPHERIC OZONE: PAST AND FUTURE	
<i>Lead Authors: P.A. Newman and J.A. Pyle</i>	
Scientific Summary	3.1
3.0 Introduction	3.5
3.1 Trends of Ozone and Temperature in the Polar Stratosphere	3.6
3.2 Basic Polar Stratospheric Processes	3.13
3.3 Quantification of Polar Ozone Loss: Observations and Models	3.41
3.4 Causes of Polar Stratospheric Temperature Trends	3.58
3.5 Chemical-Climate Modeling of the Past and Future Polar Stratosphere	3.66
References	3.81
Appendix 3A: Satellite Measurements in the Antarctic and Arctic	3.104

CONTENTS

CHAPTER 4: GLOBAL OZONE: PAST AND FUTURE

Lead Authors: M.P. Chipperfield and W.J. Randel

Scientific Summary	4.1
4.1 Introduction	4.5
4.2 Description of Past Changes in Ozone	4.6
4.3 Current Understanding of Past Changes in Stratospheric Aerosol, Water Vapor, and NO ₂	4.25
4.4 Current Understanding of Past Changes in Stratospheric Temperature	4.29
4.5 Chemical Influence on Past Changes in Ozone	4.37
4.6 Dynamical Influence on Past Changes in Ozone	4.52
4.7 Implications for Climate of Updated Stratospheric Ozone Changes	4.62
4.8 Future Changes in Ozone	4.63
4.9 Synthesis of Current Understanding of Past and Future Changes in Ozone	4.70
References	4.72
Appendix 4A: Description of Ozone Datasets	4.85
Appendix 4B: 2-D Model Scenarios	4.90

CHAPTER 5: SURFACE ULTRAVIOLET RADIATION: PAST AND FUTURE

Lead Authors: J.B. Kerr and G. Seckmeyer

Scientific Summary	5.1
5.1 Introduction	5.5
5.2 Current Understanding of Factors Affecting Surface UV Radiation	5.5
5.3 Available Resources for Studying Surface UV Radiation	5.11
5.4 UV Climatology, Temporal Changes, and Trends	5.20
5.5 Expectations of UV in the Future	5.25
References	5.31
Appendix 5A: Spectral Data Available from Databases	5.43
Appendix 5B: Internet Addresses for UV Sites	5.45

TWENTY QUESTIONS AND ANSWERS ABOUT THE OZONE LAYER

Lead Author: D.W. Fahey

Introduction	Q.1
I. Ozone in Our Atmosphere	Q.3
II. The Ozone Depletion Process	Q.8
III. Stratospheric Ozone Depletion	Q.21
IV. Controlling Ozone-Depleting Gases	Q.28
V. Implications of Ozone Depletion	Q.32
VI. Stratospheric Ozone in the Future	Q.36

APPENDICES

A LIST OF INTERNATIONAL AUTHORS, CONTRIBUTORS, AND REVIEWERS	A.1
B MAJOR ACRONYMS AND ABBREVIATIONS	B.1
C MAJOR CHEMICAL FORMULAE AND NOMENCLATURE FROM THIS ASSESSMENT	C.1